1997-98 KIRIS ASSESSMENT
Open-Response Item Scoring Worksheet

Grade 11—Science Question 22

The **academic expectations** addressed by "Effects of Hurricane Hugo on Bat Species" (Question 22) include

2.1 Students understand scientific ways of thinking and working and use those methods to solve real-life problems.

2.2 Students identify, analyze, and use patterns such as cycles and trends to understand past and present events and predict possible future events.

The **core content** assessed by this item includes

Content

- The Interdependence of Organisms – Living organisms have the capacity to produce populations of infinite size. Since environments and resources are finite, the size of the population is influenced.

Inquiry

- Formulating and revising scientific explanations and models using logic and evidence.

Effects of Hurricane Hugo on Bat Species

Use the chart below to answer the following question.

Bat Species	Food Source	Population Change
Jamaican Fruit Bat	fruit	sharp decline
Red Bat	figs	sharp decline
Long-tongue Bat	nectar from flowers	slight increase

Bats comprise 75% of the mammals native to Puerto Rico. In 1989, Hurricane Hugo flattened a large section of the rain forest in Puerto Rico. Researchers collected data about the effects of the hurricane on three different species of bats. The results are shown in the chart above.

a. Discuss **three** possible reasons for the changes in the bat populations.

b. Predict the role the bats would have in the recovery of this rain forest.

SCORING GUIDE
Grade 11 Science

Score	Description
4	The response is complete and shows a strong understanding of how a natural disaster can affect the balance in an ecosystem. There is a clear discussion of three possible reasons for the changes in bat populations, and the role bats would have in the recovery of the rain forest.
3	The response shows an understanding of how a natural disaster can affect the balance in an ecosystem. There is a discussion of two possible reasons for the changes in bat populations and the role bats would have in the recovery of the rain forest. The response may contain minor errors, misconceptions, or omissions.
2	The response shows a limited understanding of how a natural disaster can affect the balance of an ecosystem. There is a discussion of two possible reasons for the changes in bat populations or the role of bats in recovery of the rain forest; however, the response may contain errors, misconceptions, and/or omissions.
1	The response is incomplete and shows a minimal understanding of how a natural disaster can affect the balance in an ecosystem. There is an attempt to discuss reasons for change or the role of bats in the recovery of the rain forest; however, there are major errors, misconceptions, and/or omissions.
0	Response is totally incorrect or irrelevant.
Blank	No response.

Sample Student Responses

a. Reasons for changes in the bat populations include: Some bats who were out feeding were killed during the storm; the fig and fruit trees (food source) for the Jamaican Fruit Bat and the Red Bat were uprooted; smaller flowering plants were probably less affected and would grow back quicker; some bats moved to another area.

b. Bats would aid in the recovery of the rain forest by spreading seeds and pollen.

Science Behind the Question

Examples of possible reasons for the changes in bat populations and impacts of the change:

Decline in populations of Jamaican Fruit Bats and Red Bats probably were primarily due to a loss of fruit and figs destroyed by Hurricane Hugo. Both of these food sources are primarily located in trees. Many trees were uprooted and destroyed. Other trees lost fruits in heavy winds and would take a significant amount of time to regenerate. Fruit bats often roost in trees and were probably killed by the storm. As the population decreased, fewer bats dispersed seeds thereby making the impact of the storm greater.

The increase in the population of Long-tongue Bats is probably related to the shorter regeneration time of flowers. Lower-story plants, and possibly herbaceous plants, were less heavily impacted by the storm than were trees. Regrowth would be possible in a relatively short time span. It is possible that these bats roost in caves and would be safe during the storm. Greater numbers of bats would pollinate greater numbers of flowers thereby favoring successful reproduction.

ANNOTATED STUDENT RESPONSE
Grade 11 Science

Sample 4-Point Response of Student Work

Student Response

Bat populations were dramatically affected by Hurricane Hugo. The Jamaican Fruit Bat and the Red Bat both experienced declines in their populations. First, the habitat in which the bats lived was destroyed, leaving the tiny mammals with few homes in which to survive. Second, the destruction of the rain forest took away the bats' food sources which consisted primarily of fruit and figs. The wrath of Hurricane Hugo destroyed many of the trees along with the fruits that were provided.

The Long-tongue Bat, on the other hand, experienced an increase in population. The Long-tongue Bat's habitat may not have been as severely destroyed as the homes of the Jamaican Fruit Bat and the Red Bat. Natural selection may have been a contributing factor as well. The Long-tongue Bat's diet consists of nectar from flowers. Flowers are easily and quickly produced by plants following a storm (much more rapidly than fruit can be reproduced). The bats may have been able to obtain nectar from the plants in the windows and yards of residents of Puerto Rico, too.

Bats would play a major role in the rain forest's recovery. They (Long-tongue Bats), like bees, would help spread pollen to other plants throughout the rainforest so that fruit could grow. Then, bats like the Jamaican Fruit Bat and the Red Bat could obtain fruit and figs for their survival. These two species of bats would then, much like birds, spread seeds throughout the forest. Thus, the plant population would increase and the rainforest would be restored. Once again bats could reside safely within the rainforest of Puerto Rico.

Student provides two possible reasons for the declining populations of the fruit- and fig-eating bats.

Student provides two possible reasons for the increasing population of the nectar-eating bat.

Student makes an appropriate prediction about the role that the bats will have in the recovery of the rain forest and clearly explains that role.

Overall, student shows a strong understanding of how a natural disaster such as a hurricane can affect the balance in an ecosystem. Student clearly and accurately discusses several (i.e., four) reasons for the changes in the bat populations and the role bats would have in the recovery of the rain forest.

ANNOTATED STUDENT RESPONSE
Grade 11 Science

Sample 3-Point Response of Student Work

Student Response

One reason the Jamaican fruit Bat and Red Bat's population decreased is that the hurricane destroyed many fruit trees. Another reason is that flowers grow back much quicker than fruit trees. So the long-tongue bat had food quicker than the fruit-eating bats. Bats can help the rain forest grow by By dropping off seeds to grow New flowers and trees.

Student provides one reason for the declining populations of the fruit-eating bats.

Student provides one reason for the increase in the population of the nectar-eating bat.

Student makes an appropriate (albeit limited) prediction about the role that the bats will have in the recovery of the rain forest.

Sample 2-Point Response of Student Work

Student Response

A. Many bats probably died from the hurricane. Some may have flew off to another part of Puerto Rico. The Jamaican fruit bat and Red Bat may have died from starvation with no fruits to eat or no figs to eat from all the trees and things from being blown away and nothing left. Long-tongue Bat increases because nectar of flowers were blown everywhere.

B. The bat's role would be to eat fruit and figs and take nectar from flowers and drop them everywhere when they fly around. So when the seeds, figs, and nectar drop and go in the ground, trees and flowers will grow.

Student provides one reason for the declining population of the fruit-eating bat that is related to the chart data (i.e., the bats may not have had any fruit to eat).

Student attempts to predict the role that the bats will have in the recovery of the rain forest, but the response contains misconceptions (e.g., nectar helps produce flowers).

Student provides one reason for the increasing population of the nectar-eating bat that is based on the chart data. This reason, however, reveals a misconception.

ANNOTATED STUDENT RESPONSE
Grade 11 Science

Sample 1-Point Response of Student Work

Student Response

a) One of three ways bat population wet down was because of natural deforestion, Less food for the bats, and the weeker bats not finding enough foods.

B) Bats will have to adaped to the loss and hunt more sciffally.

← Student suggests one very general reason for the declining bat populations, but does not address the increase in the population of the Long-tongue bat.

← Student predicts how the bats will respond to the disaster rather than what role they will have in the recovery of the rain forest.

INSTRUCTIONAL STRATEGIES
Grade 11 Science

The open-response item "Effects of Hurricane Hugo on Bat Species" was designed to assess students' ability to (1) accurately interpret data from a chart, (2) understand the interdependency of organisms in an ecosystem, (3) understand that an ecosystem can recover from the short-term effect of a natural disaster, and (4) predict how the recovery of an ecosystem is affected by the interdependency of organisms. The instructional strategies below present ideas for helping students explore and master these concepts and skills.

Discuss the following concepts and skills:

- organisms in an ecosystem are interdependent
- the interdependency of organisms can affect the recovery of an ecosystem after its destruction due to a natural or man-made disaster
- animals are an important factor in seed dispersal
- how to accurately interpret data from a chart

Have students work individually, in pairs, and/or in small groups to complete any or all of the following activities:

- Study the role of animals in seed dispersal. Write a newspaper article describing the role of a type of animal in the recovery (succession) of an ecosystem after its destruction due to a natural or man-made disaster.
- Write a research report on how the wildlife was affected in an area that was destroyed by a natural disaster such as the fire in Yellowstone National Park. How is the area different from before the disaster? What factors are responsible for the area's rate of recovery? Are there factors that have impeded the area's recovery?
- Practice interpreting charted data that was collected from experiments or research conducted by someone other than the students. In small groups, compare and contrast their interpretations.
- Discuss the effects of a natural disaster on local ecosystems. List both short-term and long-term effects of the disaster. Analyze the role of the interdependence of organisms in the recovery of the ecosystem.
- Describe a food web or a local ecosystem and discuss the implications if parts of the web are broken. Predict what could cause the web to break and what could help to restore the connections.
- Design a plan to study the effects of a natural disaster on the ecosystem of an area and a way to monitor its recovery. The plan should specify methods of determining the area affected and the nature of the disaster/habitat destruction. The plan should also identify the interdependence that exists between organisms in the ecosystem. Other factors to address: the type of information to be collected; the type of test(s) to be conducted; the design of a chart(s) for presenting data. Also, include in the plan a prediction of what the short-term and long-term effects would be on the area.